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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/707,517	12/19/2003	Shao-Chung Hu	NAUP0541USA	1516
27765	7590	06/30/2004	EXAMINER	
NAIPO (NORTH AMERICA INTERNATIONAL PATENT OFFICE)			THOMAS, TONIAE M	
P.O. BOX 506			ART UNIT	PAPER NUMBER
MERRIFIELD, VA 22116			2822	

DATE MAILED: 06/30/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/707,517

Applicant(s)

HU ET AL.

Examiner

Toniae M. Thomas

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 19 December 2003.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-21 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-21 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 19 December 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

### DETAILED ACTION

1. This is a first Office action on the merits of Application Serial No. 10/707,517.

Currently, claims 1-21 are pending.

#### *Specification*

2. The specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

#### *Claim Rejections - 35 USC § 102*

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless -

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. *Claims 1-8, 11-18, and 21 are rejected under 35 U.S.C. 102(b) as being anticipated by Werkhoven et al. (US 2001/0041250 A1).*

The Werkhoven et al. patent (Werkhoven) discloses a method of forming at least one dual damascene wire on a substrate (figs. 9, 10, and accompanying text). The method comprises the steps of: forming a barrier layer 432 on a surface of an insulating layer 402, 404, 408, 410 and on an exposed conductive region 406 - the insulating layer including a trench pattern and a via hole pattern formed therein (figs. 9, 10, and par. 101, lines 1-3); forming a continuous and uniform conductive layer 434 on a surface of

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the barrier layer (figs. 9, 10, and par. 101, lines 1-3); forming a seed layer 436 on a surface of the conductive layer (figs. 9, 10, and par. 101, lines 1-3); and forming a metal layer 426 on a surface of the seed layer, wherein the metal layer fills the trench pattern and the via hole pattern (fig. 9; par. 99, lines 1-3; par. 101, lines 8-10; and par. 135, lines 1-4).

The substrate comprises a semiconductor wafer (par. 42, lines 1-7).

The conductive region 406 comprises a lower level wire or landing pad (fig. 9 and par. 96, lines 3-5 and 10-12).

The barrier layer 432 comprises a titanium nitride layer (TiN), tungsten nitride (WN), tantalum nitride layer (TaN), or other conductive nitride layers (par. 101, lines 3-5).

The conductive layer 434 comprises a tungsten (W) layer (par. 102, lines 3-6; par. 103, lines 10-21; and par. 123, line 1 – par. 125, line 7).

The conductive layer 434 is formed using an atomic layer deposition (ALD) process, and has a thickness in a range from 5 to 400 angstroms (Å) (par. 103, lines 14-21; par. 123, line 1 – par. 125, line 7; and par. 131, lines 3-8).

The seed layer 436 is a copper layer, which has a thickness in a range from 5 to 2000 angstroms (Å) (par. 103, lines 23-28 and par. 134, lines 1-6).

An electric copper plating (ECP) process is used to form the metal layer 426 (par. 135, lines 1-4).

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. *Claims 9, 10, 19, and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Werkhoven in view of Tarumi et al. (US 2004/0018722 A1).*

Werkhoven lacks anticipation only in not teaching that: the seed layer is a copper alloy, and is formed using a physical vapor deposition (PVD) process.

The Tarumi et al. Patent (Tarumi) discloses a method of forming at least one dual damascene wire on a substrate (figs. 1A-6B and accompanying text). The method comprises a step of forming a seed layer 21, wherein the seed layer is either a copper layer or a copper alloy layer (fig. 4B and par. 48, lines 1-8). The seed layer is formed using a sputtering process, which is a PVD process (par. 48, lines 1-8).

Since Werkhoven and Tarumi are from the same field of endeavor, the purpose disclosed in Tarumi would have been recognized in the pertinent reference of Werkhoven by one of ordinary skill in the art at the time the invention was made.

It would have been obvious to one having ordinary skill in the art, at the time the invention was made, to modify Werkhoven in view of Tarumi, by forming the seed layer of a copper alloy and using a PVD process to form the seed layer, as taught by

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Tarumi, for the following reasons: as in the case of copper, a copper alloy with a relatively high percent composition of copper enables direct nucleation of electroplated copper; and sputtering is an alternate deposition process commonly used to form copper-containing seed layers in dual damascene structures.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Toniae M. Thomas whose telephone number is (571) 272-1846. The examiner can normally be reached on Monday-Thursday from 8:30 AM to 5:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian can be reached on (571) 272-1852. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

*TMJ*

21 June 2004



**Mary Wilczewski**  
**Primary Examiner**